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Lichenological notes 3: *Sarcogyne plicata* in California

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Abstract — *Sarcogyne plicata*, a California endemic, is revised and discussed. A taxon referred to in the literature as *Sarcogyne "privigna,"* which looks similar to *S. plicata* and is sympatric in California, is discussed. The name is considered invalid for the taxon.

Key words — *Acarosporaceae*, caliciphile, Joshua Tree National Park, nomenclature

Introduction

The type of *Sarcogyne* Flot. is *S. corrugata* Flot. (= *S. clavus* (DC.) Kremp.) (Jørgensen & Santesson 1993). The genus currently comprises species with lecideine apothecia with an excipulum of melanized (or even carbonized) hyphae that lack any epihymenial accretions as are found in species currently included in *Polysporina* Vězda. The exact number of species in the genus is unknown, partly because the current generic circumscription is paraphyletic (Reeb et al. 2004; Westberg, pers. comm.) and partly because many species need revision or are known only from lost types (Knudsen & Standley 2007; Lendemer et al. 2009b).

In North America we currently recognize 15 described *Sarcogyne* species. Twelve species are known from collections made in the last 15 years: *S. arenosa* (Herre) K. Knudsen & S.M. Standl. (Knudsen & Standley 2007; Lendemer et al. 2009a), *S. clavus* (Magnusson 1935a, b; Harris & Ladd 2005; Knudsen & Standley 2007), *S. crustacea* K. Knudsen & Kocourk. (Knudsen & Kocourková 2010), *S. dakotensis* H. Magn. (Magnusson 1935b; Knudsen & Standley 2007), *S. desolata* (H. Magn.) K. Knudsen & S.M. Standl. (Knudsen & Standley 2007), *S. novomexicana* H. Magn. (Knudsen & Lendemer 2005; Knudsen & Standley 2007), *S. plicata* (Magnusson 1935b; Knudsen & Kocourková 2009),

S. "*privigna*" (Magnusson 1935a, b; Harris & Ladd 2005; Knudsen & Standley 2007), *S. reebiae* K. Knudsen (Knudsen & Standley 2007; Knudsen et al. 2011), *S. regularis* Körb. (Knudsen 2007; Harris & Ladd 2005), *S. similis* H. Magn. (Magnusson 1935b; Harris & Ladd 2005; Knudsen & Standley 2007), and *S. sphaerospora* J. Steiner (Lendemer et al. 2009b). Three species are known only from lost type collections: *S. athroocarpa* H. Magn., *S. integra* B. de Lesd. ex H. Magn., and *S. magnussonii* B. de Lesd. (Magnusson 1935b; Knudsen & Standley 2007). We have not seen any taxa fitting the descriptions of these three species that could be used for neotypification.

We are currently researching the biodiversity and taxonomy of the lichenized, lichenicolous, and rock-inhabiting fungi of Joshua Tree National Park. In the park, *Sarcogyne plicata*, originally described from California (Magnusson 1935b), is sympatric with *S.* "*privigna.*" Knudsen & Standley (2007) previously treated *S. plicata* as a synonym of *S.* "*privigna*" because it was unclear how to delimit many specimens from *S.* "*privigna*" as then interpreted (see discussion below). Unpublished molecular work by Martin Westberg (Westberg, pers. comm.) supported *S. plicata* as distinct from *S.* "*privigna,*" and we accepted both species although we were still unclear how to differentiate the two (Knudsen & Kocourková 2009). In this paper we revise *Sarcogyne plicata*.

Materials & methods

Specimens were examined from COLO, FH, NY, UCR, and UPS. Specimens were studied in hand sections using standard microscopy. Structures were examined in water and KOH and measured in water. Amyloid reactions were tested with IKI. Hymenial height does not include the height of the subhymenium, a valuable secondary character in distinguishing some species. Thin-layer chromatography was performed by J.C. Lendemer on *Sarcogyne plicata*, Knudsen 1230 (NY) (Culberson & Kristinsson 1970). Images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. The illustrations were prepared using Adobe Photoshop. All measurements are based on water mounts of hand cut sections unless otherwise indicated.

The species

Sarcogyne plicata H. Magn., Ann. Crypt. Exot. 7: 134 (1935). Fig. 1

Type: **U.S.A. California**. San Bernardino Co., Upland. On plaster of wall. 17.11.1917, I.M. Johnston s.n. (Holotype, FH!).

Description — Thallus endolithic to chasmolithic, sometimes visible between granules of substrate or beneath apothecia as white cushion of plectenchyma. Vegetative hyphae mostly 1–2 µm in diam., cells mostly 4–5 µm long, thin-walled, I–, mixed with crystals of substrate, forming a gelatinized mass binding the substrate, continuous with the hypothecium and excipulum hyphae, not forming a distinct medulla. Algal layer usually scattered in substrate or not observable, algae chlorococcoid 10–15 µm in diameter.

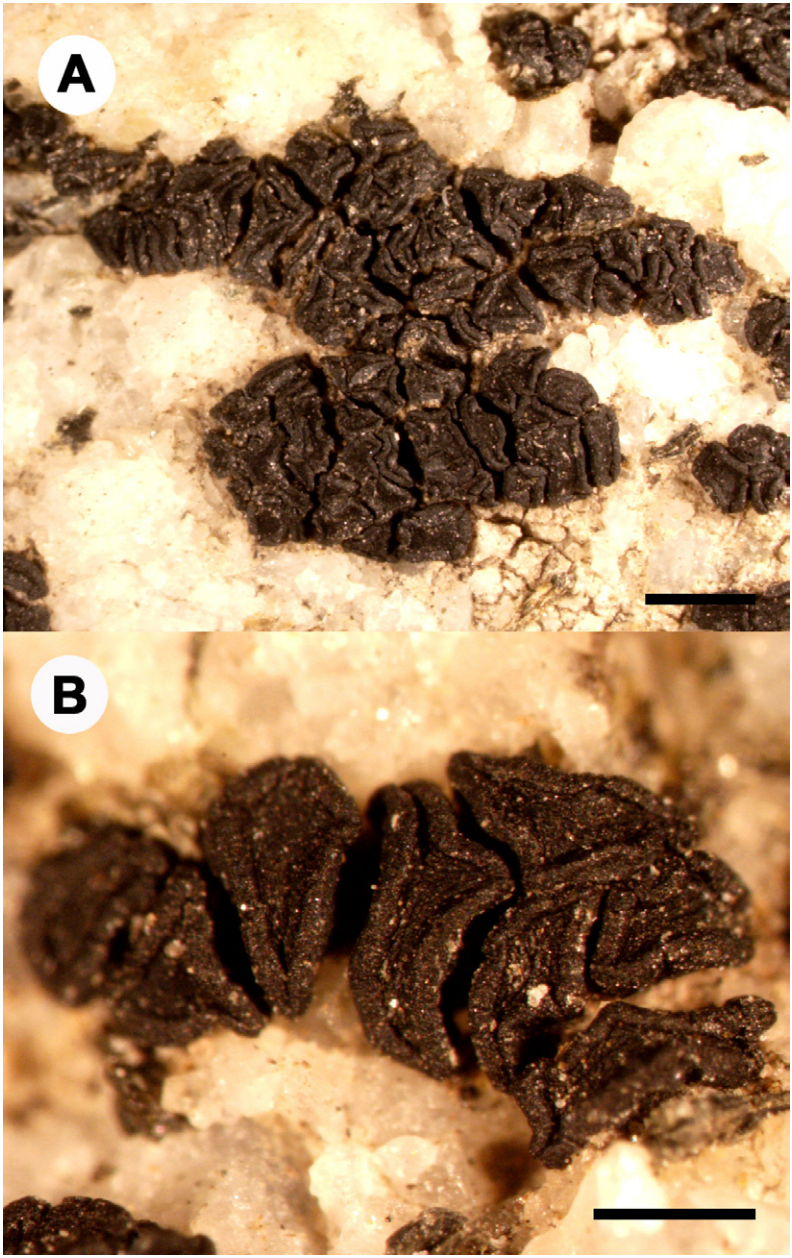

Fig. 1. *Sarcogyne plicata* (Knudsen 1230).
A. Apothecia. Scale = 1mm; B. Apothecia. Scale = 0,5 mm.

Apothecia usually contiguous and apparently not dividing vegetatively, dull black, epruinose, black when wetted, round, angular, to long and narrow (then vaguely resembling an *Opegrapha*), the disc black, visible or obscure, not turning red when wetted, often less than 0.5 µm in diameter or in length, up to 1 mm. Surface of disc without epihymenial accretions as in *Polysporina* species but rarely with an umbo, which is a remnant of the ontogeny of the apothecium. Excipulum distinct, melanized, up to 100 µm thick, outer layer dark (hyphae not visible), inner layer to 40 µm thick, golden yellow to red-brown, raising above the disc and even hiding it when dry, not melanized beneath the disc, sometimes swollen like labia, or in segments fused often at angles to each other through compression. Hymenium 100–140 µm tall, hyaline, I+ blue; epihymenium golden yellow, to 15 µm tall, thick, paraphyses septate, mostly 1.5–2.0 µm tall, with oil drops, with moderate branching, upper three cells sometimes becoming wider to 4 µm, apices usually expanded up to 4 µm, often in pigment cap. Asci 70–85 × (17–)20–25 µm, over 100 ascospores per ascus. Ascospores hyaline, simple, 3–5 × 1–2 µm, variable in size. Subhymenium golden yellow, to 50–80 thick, I+ blue. Hypothecium continuous with attaching hyphae, forming the base of apothecia, to 300 µm thick, without algal layer. Conidiomata not seen. No lichen substances found with TLC.

Selected specimens examined — **U.S.A. California.** Orange Co., Santa Ana Mountains, Fremont Canyon, on granite, 268 m, Sept. 22, 2008, K. Knudsen 10329 (UCR); on granite rocks eroded out of sandstone, 343 m, Dec. 6, 2007, K. Knudsen 9354 (UCR); 200 m, on conglomerate rock, Oct. 5, 3007, K. Knudsen 9004.2 (UCR); 956 m, Sept. 18, 2008, K. Knudsen 10310 (UCR); Riverside Co., Wildomar, Menifee Hills, on granite wall along seasonal stream, 558 m, Jan. 2, 2004, K. Knudsen 2124 (UCR); 635 m, granite drainages, Dec. 28, 2005, K. Knudsen 4837 (UCR); 543 m, crumbling granite along stream, Oct. 14, 2009, K. Knudsen 11782 (UCR); Joshua Tree National Park: Pleasant Valley, wash crossing Geology Tour Road, 1049 m, on flat granite rock, Dec. 3, 2010, K. Knudsen 12689 (UCR); Malapai Hill, south-facing base on granite rubble, 1165 m, Dec. 2, 201, K. Knudsen 12636.1 & 12636.2 (UCR); Squaw Tank, on dissected decaying quartz dike on monzogranite dome, 1092 m, Dec. 4, 2010, K. Knudsen 12748 (UCR); desert between Skull Rock & Jumbo Rocks, 1347 m, on monzogranite, Dec. 19, 2010, K. Knudsen 13150 (UCR); San Jacinto Mountains, along Forbes Ranch Road, on granite on pebble plain, 1651 m, March 26, 2006, K. Knudsen 5698 (UCR); San Bernardino Co., Granite Mountains, above Granite Cove, along wash, 1335 m, on granite slab, June 6, 2008, K. Knudsen 9687 (UCR); Joshua Tree National Park, Key's Ranch, 1267 m, on granite in washes, May 26, 2005, K. Knudsen 3041 w/ T. LaDoux (UCR); San Gabriel Mountains, San Antonio Creek, in wash behind San Antonio Dam, 761 m, on hard granite boulders in flood plain, June 4, 2004, K. Knudsen 1230 (ASU, MIN, NY, UCR); Santa Ana River Valley, base of San Bernardino Mountains, along Greenspot Road, on granite boulders in floodplain, 533 m, May 1, 2006, K. Knudsen 5936 w/ M. Knudsen (UCR); Woolly Star Preserve, 327 m, on granite boulder, Feb. 7, 2011, K. Knudsen et al. 13570 (UCR); Ventura Co., Santa Monica Mountains, Tri-Peaks near Backbone Trail, 829 m, on Conejo volcanics, May 13, 2007, K. Knudsen 8397 (UCR); Yerba Buena Canyon area, 409 m, March 22, 2006, K. Knudsen 5623 w/ D. Magney (UCR).

Ecology & distribution — *Sarcogyne plicata* is frequent in southern California, often locally abundant, usually occurring on granite in drainages, washes and flood plains, often a solitary pioneer in full sun, at elevations from 200 to 1651 meters. A few collections from the Santa Monica Mountains are on Conejo volcanics. No populations have been found on calcareous rock. It is currently considered endemic to California, occurring in the Mojave Desert (Granite Mountains and Joshua Tree National Park) and in the coastal mountains and foothills of southern California in the Peninsular Ranges (Menifee Hills, Santa Ana Mountains, San Jacinto Mountains) and in the Transverse Ranges (San Bernardino Mountains, San Gabriel Mountains, and Santa Monica Mountains).

Discussion — A typical *S. plicata* specimen (Fig. 1) is quite distinctive from *S.* "*privigna*" (Fig. 2), but many specimens can be quite similar. For instance, a *S. plicata* thallus with many round apothecia may resemble *S.* "*privigna,*" while a *S. "privigna*" thallus with many compressed apothecia may be identified as *S. plicata*. While *S.* "*privigna*" usually has discs that appear red even when dry, some thalli have mostly blackish apothecia. Fortunately *S.* "*privigna*"

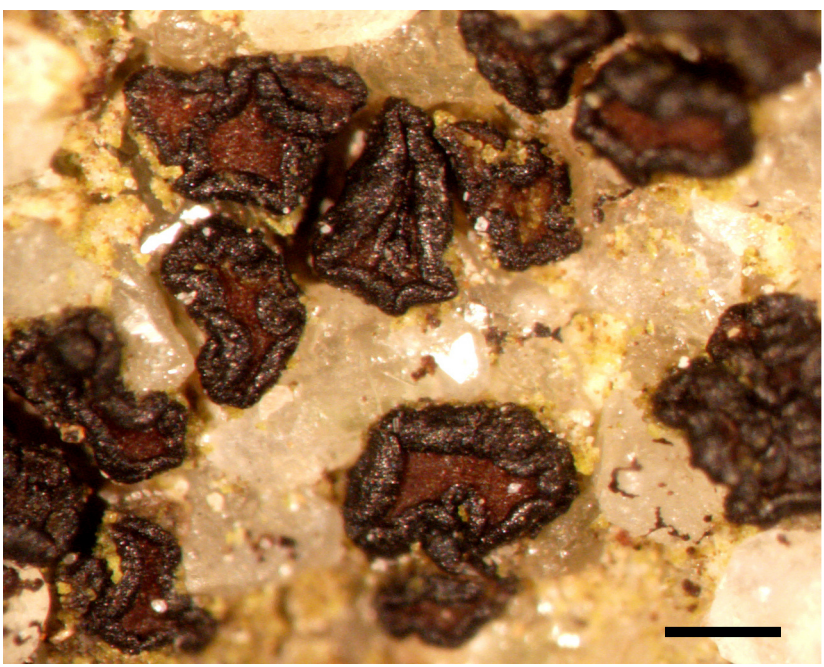

Fig. 2. *Sarcogyne 'privigna*' (Harris 42777).
Apothecia. Scale = 250 μm.

discs always turn red when dampened with water while *S. plicata* discs remain black. Otherwise *S. plicata* has a taller hymenium (100–140 µm) and deeper subhymenium (50–80 µm) than *S.* "*privigna*" (60–85 µm and 30–40 µm, respectively). One site where both species occurred was in Joshua Tree National Park at Key's Ranch. The site has extensive monzogranite boulders forming a maze of small alkaline washes, which commonly contain rock crevices and fissures rich in calcium deposited during seasonal flooding and subsequent evaporation. *Sarcogyne* "*privigna*" was common in these calcareous microhabitats. *Sarcogyne plicata* was frequent in the more acidic microhabitats found on the tops of monzogranite boulders that are not inundated during flooding and thus lack calcium deposits. In areas of the Mojave Desert like Cactus Flats (San Bernardino Mountains) or in the Clark Mountains, where limestone predominates, *S.* "*privigna*" was abundant and no *S. plicata* was collected.

The problem of *Sarcogyne "privigna"* auct., non (Ach.) A. Massal. FIG. 2

Lichenologists generally agree as to which taxon should be referred to *Sarcogyne* "*privigna*" (for instance: Magnusson 1935a, b; Clauzade & Roux 1985; Golubkova 1988; Knudsen & Standley 2007; Seppelt et al. 1998; Fletcher & Hawksworth 2009). However, the Acharius type of the basionym *Lecidea privigna* Ach. 1803 (and thus Massalongo's 1854 combination in *Sarcogyne*) represents *Polysporina simplex* (Taylor) Vězda (Magnusson 1935a). The Acharius types of the other possible basionym, *Lecanora milvina* var. *privigna* Ach. 1810, appear to represent *Polysporina simplex* and/or an *Acarospora.* For descriptions see Clauzade & Roux (1985), Magnusson (1935a, b), Knudsen & Standley (2007), and Fletcher & Hawksworth (2009). Thus the *S.* "*privigna*" now recognized by many authors does not have a validly published name (Magnusson 1935a; Knudsen & Standley 2007).

Sarcogyne plicata is restricted to a small area within the range of the more cosmopolitan *S.* "*privigna*". As noted above *S.* "*privigna,*" can generally be separated from the often similar to *S. plicata* based on its shorter hymenium and shallower subhymenium. The species also sometimes retains a vestige of apothecial development in the form of an umbo in the center of the disc that usually eventually disappears. Also as noted above, the easiest way to differentiate the two species is that *S.* "*privigna*" discs (usually red or red-orange when dry) are brighter when wet, while the black *S. plicata* discs remain black even when wet. The *S.* "*privigna*" pycnidia we observed were ca. 0.1–0.2 mm diam., while conidia were simple, hyaline, and 1.0–2.0 × 0.5–1.0 µm.

SELECTED SPECIMENS EXAMINED — **CZECH REPUBLIC.** BOHEMIA, Jeseníky, 500 m, May 9, 1961, A. Vězda, Lichenes Selecti Exsiccati 95 (COLO); **GREECE.** RETHIMNO, Mt. Psiloritis, on calcareous rock, 800 m, March 31, 1993, A. Nordin 3129 (UPS); SAMOS: west end of the island, 156 m, on limestone, D.J. Hill s.n. (UCR); **ITALY.** LOMBARDY,

Bormio, 1250 m, on stone fence, July 24, 1927, A.H. Magnusson 10675 (UPS); **NORWAY.** Troms, Storfjord Par., rocky slope, 60 m, on horizontal calcareous rock, Aug. 6, 2003, A. Nordin 5633 (UPS); **SLOVAKIA.** Bratislavský Svätý Jur, in vineyard, July 20, 1922, A.H. Magnusson 6825 (UPS); **SWEDEN.** Gotland, Fårö par., Gotska Sandön, on human bone, May 14, 1921, T. Vestergren (UPS); Lyckselle Lappmark, Tärna par., 520 m, Aug. 30, 1963, G.E. Du Rietz 675D (UPS); Södermanland, Östra Vingåker par., on calcareous rocks, Aug. 11, 1913, A.H. Magnusson s.n. (UPS) Västergötland, Lerdala pars., Sparresäter, on rocks in wood, July 12, 1934, A.H. Magnusson 14261 (UPS); Meddelplana par., Hällekis, on gneiss, July 12, 1942, A.H. Magnusson 18214 (UPS); **U.S.A. California.** Los Angeles Co., Santa Monica Mountains, Hennessey, south of Castro Crest, 445 m, on calcium carbonate accretions on sandstone, May 31, 2009, K. Knudsen 11169 (UCR); Orange Co., Santa Ana Mountains, Fremont Canyon, 587 m, on sandstone, Sept. 18, 2008, K. Knudsen 10303 (UCR); Riverside Co., Joshua Tree National Park, Hexie Mountains, Stirrup Tank, 1040 m, on granite, Dec. 26, 2010, K. Knudsen 13313 (UCR); base of Hexie Mountains at head of Fried Liver Wash, 983 m, rare on granite rocks along wash, Dec. 12, 2010, K. Knudsen 13013 (UCR); Ryan Mountain, 1568 m, on small granite rock in drainage, Dec. 6, 2010, K. Knudsen 12842 (UCR); Sheep's Pass, west-facing slope covered with rubble and pebbles, 1369 m, on decaying granite, Dec. 20, 2010, K. Knudsen 13218 (UCR); Upper Juniper Flats, on soft granite, 1497 m, Dec. 18, 2010, K. Knudsen 13107 (UCR); San Bernardino Co., Clark Mountains, 1535 m, on limestone, Oct. 11, 2009, K. Knudsen 11768 w/ N. Pietrasiak (UCR); Granite Mountains, canyon above Yucca Bajada camp, 1219 m, Oct. 20, 2007, K. Knudsen 9391 (UCR); Joshua Tree National Park, Key's Ranch, on monzogranite in alkaline wash, 1283 m, Apr. 1, 2005, K. Knudsen et al. 2622 (UCR); San Bernardino Mountains, Cactus Flats, 1905 m, common on calcareous rock, June 7, 2005, K. Knudsen 3284 (UCR); Bear Mountain, 2652 m, on dolomite, Aug. 25, 2005, K. Knudsen 1609 w/ C.L. Wagner (ASU, UCR); pebble plain along Polique Canyon Road, on granite rock, 2282 m, Aug. 25, 2011, Knudsen 13674 w/ S. Eliason (UCR); San Diego Co., Anza Borrego, Sentenac Canyon, 677 m, on granite in drainage, Dec. 23, 2005, K. Knudsen 4832 et al. (UCR); Laguna Mountains, The Point, 1825 m, on vertical granite walls, June 2, 2004, K. Knudsen 1223 (ASU, UCR); Santa Barbara Co., Santa Rosa Island, bottom of Dry Canyon, 96 m, on sandstone along seasonal stream, Oct. 24, 2008, K. Knudsen 10538 (UCR); **Georgia.** Putnam Co., Oconee National Forest, on sandstone, Sept. 16, 1996, W.R. Buck 30477 (NY); **Kansas.** Russell Co., west of Bunker Hill, 479 m, on sandstone, June 25, 2007, C.A. Morse 15459A (KANU, UCR); **Kentucky.** Harlan Co., Profile Rock, 763 m, on sandstone, Sept. 16, 1991, R.C. Harris 27175 (NY); **Maine.** Kennebec Co., Mud Pond, disturbed area under power lines, Sept. 19, 1987, on granite, R.C. Harris 20896 (NY). **Maryland.** Anne Arindel Co., On Wishing Rock, Raritan formation, Nov. 25, 1987, Clyde F. Reed (NY); Frederick Co., Sugar Loft Mountain, on rocks along Mt. Ephram Rd., Apr. 19, 1962, Clyde F. Reed (NY); **Missouri.** Carter Co., bluff on e-side of Current River, on top of granite boulder, R.C. Harris 25629 (NY); Madison Co., Castor River Shut-Ins Natural Area, on granite bedrock, Oct. 21, 2001, R.C. Harris 45075, 45069-A (NY). **New Mexico.** San Juan Co., Chaco Canyon National Monument, 1090 m, on sandstone, Aug. 6, 1979, T.H. Nash III, 16362 (ASU); **North Carolina.** Jackson Co., Cedar Cliff Mountains, Oct. 11, 1998, on schist and gneiss, R.C. Harris 42777 (NY); **Ohio.** Gallia Co., Wayne National Forest, Symes Creek Natural Area, 215 m, May 21, 2006, on sandstone, W.R. Buck 50330 (NY); **Pennslyvannia.** Blair Co., Tussey Mountain, on sandstone talus, Apr. 22, 2008, R.C. Harris 54291 (NY); Franklin Co., Michaux State Park, n-slope of Rocky mountain, c. 350 m, June 1, 2009, J.C. Lendemer 18182 (NY); Lycoming Co., Tioga State Forest,

Algerine Swamp Natural Area, c. 548 m, May 14, 2009, on rock, J.C. Lendemer 16992 (NY); **Vermont.** Lamoille Co., Smuggler's Notch, rocks at base of a cliff, Sept. 21, 1985, R.C. Harris 18222 (NY); **West Virginia.** Grant Co., Shroud Ridge, on sandstone, 425 m, W.R. Buck 38252 (NY).

Ecology & distribution — *Sarcogyne* "*privigna*" occurs on calcareous rock as well as non-calcareous rock such as granite, gneiss, sandstone and volcanic rock in drainages, washes, and flood plains potentially rich in calcium carbonate deposited in the fissures of rocks during inundation and subsequent evaporation. The species is widespread and found in Africa, Asia, Europe, North America, Antarctica, and Australia (Fletcher & Hawksworth 2009; Golubkova 1988; Seppelt et al. 1998).

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